

Prof. Richard KP Benninger

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Emergent multi-cellular dynamics governing hormone secretion in the endocrine pancreas



Most biological systems exist as dynamic multicellular structures where distinct functionalities are generated through cellular interactions. The islets of Langerhans are multicellular micro-organs within the pancreas that are integral to maintaining glucose homeostasis through secretion of the hormone insulin. β -cells within the islet exist as a highly coupled electrical network which coordinates electrical activity and insulin release. I will present our ongoing research that describes how the overall electrical dynamics across the islet emerges from the electrical connections between heterogeneous sets of β -cells. This includes

how the islet leverages connectivity and heterogeneity to provide robustness across the islet β -cell network in responding to glucose. We further examine how subsets of specialized β -cells drive the electrical dynamic across the islet β -cell network. With knowledge of the underlying dynamics of the islet and hormone release, we can develop diagnostics and therapeutic interventions to effectively manage, cure and prevent diabetes, a disease in which glucose homeostasis is dysregulated.

Short bio

Dr Benninger completed both his MSci and PhD in physics from Imperial College London, in London UK. His PhD work concerned the development of high-speed multi-photon microscopy and fluorescence lifetime imaging. He then completed his postdoctoral studies in Molecular Physiology and Biophysics at Vanderbilt University in Nashville TN. It was here that he started applying advanced microscopy techniques to biological applications, including the islet of Langerhans. In 2011 he started his tenure-track faculty position at the University of Colorado Denver|Anschutz medical campus in the Department of Bioengineering, where he is now an Associate Professor. Dr Benninger's laboratory is located in the Barbara Davis center of childhood diabetes, where he has developed a highly multidisciplinary research program focusing on applying engineering principals and technologies to study the endocrine pancreas (islets of Langerhans) over multiple levels of organization. He has published over 60 peer-reviewed publications, been awarded >\$10M in research funding, and has mentored 13 pre and postdoctoral trainees – the latter being one of the activities he values the most.